Original Research

CHANGES IN NUTRITIONAL STATUS AND DIETARY INTAKE AMONG PATIENTS WITH UPPER GASTROINTESTINAL CANCER RECEIVING MULTIMODAL TREATMENT AT MILITARY HOSPITAL 175

DO Viet Canh[1,3], DAO Tien Manh[2], NGUYEN Duy Dong[3], PHAM Duc Minh[3,✉]

[1] *Military Hospital 13, Gia Lai Province, Vietnam*
[2] *Military Hospital 175, Ho Chi Minh City, Vietnam*
[3] *Military Hospital 103, Vietnam Military Medical University, Hanoi, Vietnam*

ABSTRACT

Aims: To describe longitudinal changes in nutritional status and dietary intake among patients with upper gastrointestinal cancer receiving multimodal treatment at Military Hospital 175.

Methods: A longitudinal observational study was conducted in 62 patients with esophageal or gastric cancer. Assessments were performed before treatment (T0), after 2 weeks (T1), after 1 month (T2), and after 3 months (T3). Nutritional status was evaluated using body weight, BMI, and the Patient-Generated Subjective Global Assessment (PG-SGA). Dietary intake was assessed using repeated 24-hour dietary recalls.

Results: The mean age was 62.7 ± 8.5 years; 91.9% were male, and 85.5% had stage III–IV disease. Body weight decreased significantly from 55.45 ± 10.30 kg at T0 to 51.43 ± 8.19 kg at T3, and BMI declined from 21.94 ± 4.07 to 20.34 ± 3.24 kg/m² ($p=0.001$). PG-SGA score increased from 8.66 ± 3.35 at T0 to 9.69 ± 2.85 at T1, then decreased to 6.43 ± 3.03 at T3 ($p<0.001$). Energy intake decreased at T1 and then partially recovered by T3, with a significant overall change over time ($p=0.011$). Protein and carbohydrate intake showed similar early declines followed by partial recovery, whereas lipid intake remained relatively stable.

Conclusion: Patients with upper gastrointestinal cancer experienced significant nutritional changes during the first three months of multimodal treatment. The early treatment phase, particularly the first two weeks, represents a vulnerable period for nutritional deterioration. Regular assessment using PG-SGA, anthropometric indicators, and dietary intake evaluation should be integrated into multimodal cancer care to support timely nutritional intervention.

Keywords: *upper gastrointestinal cancer, PG-SGA, BMI, dietary intake,* malnutrition.

I. INTRODUCTION

Upper gastrointestinal cancer, particularly gastric cancer and esophageal cancer, is a group of malignancies associated with a high burden of disease and mortality. According to GLOBOCAN 2022, gastric cancer and esophageal cancer remain among the most common cancers and leading causes of cancer-related death worldwide. Gastric cancer accounts for nearly 1 million new cases annually, while esophageal cancer accounts for more than 500,000 new cases each year [1].

✉ Corresponding author: PHAM Duc Minh
Email: drminh103@yahoo.com
Doi:10.56283/1859-0381/1091.

Submitted: 15/4/2026 Revised: 20/4/2026
Accepted: 26/4/2026
Published online: 28/4/2026

Malnutrition is a common problem among patients with cancer, especially those with upper gastrointestinal cancer, because both the tumor itself and anticancer treatment can directly affect food intake, digestion, absorption, and metabolism. According to ESPEN guidelines, malnutrition in cancer patients results from the combined effects of the tumor and treatment modalities such as surgery, chemotherapy, and radiotherapy. Early detection and management of nutritional disorders are therefore important components of comprehensive cancer care [2].

In clinical practice, BMI is simple and easy to apply, but it has limitations because it does not fully reflect changes in dietary intake, nutrition-impact symptoms, loss of muscle mass, or metabolic burden. The Patient-Generated Subjective Global Assessment (PG-SGA) is widely used to assess nutritional status in patients with cancer, as it integrates multiple domains including weight change, dietary intake, symptoms, functional capacity, and physical examination. The landmark study by Bauer et al. demonstrated that PG-SGA is an appropriate tool for nutritional assessment in cancer patients [3].

In Vietnam, longitudinal data on changes in nutritional status and dietary intake among patients with upper gastrointestinal cancer during multimodal treatment remain limited. Therefore, this study was conducted to describe changes in nutritional status and dietary intake during the first 3 months of multimodal treatment among patients with upper gastrointestinal cancer at Military Hospital 175.

II. METHODS

2.1. Study design

This was an analytical longitudinal observational study conducted at the Institute of Oncology and Nuclear Medicine, Military Hospital 175, from September 2025 to April 2026. Patients were assessed at four time points: before multimodal treatment (T0), after 2 weeks (T1), after 1 month (T2), and after 3 months (T3). At T0, patients underwent diagnostic confirmation, disease staging, assessment of general condition, surgical eligibility, and nutritional status before treatment initiation. Subsequently, depending on cancer type, TNM stage, histopathology, surgical eligibility, and performance status, patients received appropriate multimodal treatment strategies, including surgery, chemotherapy, radiotherapy, concurrent chemoradiotherapy, systemic therapy, or palliative care as indicated by specialists [4-6].

2.2. Study subjects

The study included patients with esophageal or gastric cancer treated at Military Hospital 175. Patients were eligible if they were aged ≥18 years, had a histologically confirmed diagnosis of esophageal or gastric cancer, had not initiated multimodal cancer treatment before enrollment, were able to complete the interview and nutritional assessment, and provided written informed consent. Patients were excluded if they had recurrent disease, another concurrent malignancy, severe acute or chronic conditions that could substantially affect nutritional status, cognitive impairment preventing study participation, enteral tube feeding or total parenteral nutrition at baseline, or refusal to participate.

2.3. Sample size and sampling

The sample size was calculated using the formula for estimating a proportion in a descriptive study:

$$n = Z^2_{1-\alpha/2} \text{x} \frac{p.(1-p)}{d^2}$$

Where p = 0.807 was the estimated prevalence of malnutrition according to PG-SGA from a previous study [7]; d = 0.1 was the allowable absolute error, and the confidence level was set at 95%. The minimum required sample size was 60 patients. In practice, 62 patients with upper gastrointestinal cancer were recruited using a convenience sampling method.

2.4. Study variables and outcome measures

The study variables included age, sex, cancer type, disease stage, treatment modality, body weight, height, BMI, 24-hour dietary intake, energy intake, protein intake, lipid intake, carbohydrate intake, and PG-SGA score. BMI was calculated as body weight divided by height squared and expressed in kg/m².

Dietary intake was assessed at each study time point using a 24-hour dietary recall repeated over 3 days, based on a previously conducted study [8]. Investigators recorded all foods, beverages, and oral nutritional supplements consumed by the patients during the 24 hours preceding each interview. Food quantities were converted into grams of edible portions. Energy and nutrient values were calculated using the Vietnamese Food Composition Table. Dietary intake at each time point was expressed as the mean value of the three 24-hour recalls.

Nutritional status was assessed using the PG-SGA tool, which includes weight change, dietary intake, nutrition-impact symptoms, functional capacity, disease-related factors, and physical examination. A higher PG-SGA score indicates greater nutritional risk and a higher need for nutritional intervention [3].

2.5. Data analysis

Data were analyzed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables are presented as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. Descriptive statistics at each time point were calculated from observed data.

Longitudinal changes in dietary intake and nutritional status indicators were analyzed using linear mixed-effects models, which are appropriate for repeated-measures data with unequal follow-up observations [9]. Time was included as a fixed effect, and participant identification number as a random effect. The overall effect of time was assessed using Type III tests of fixed effects. Pairwise comparisons were performed using estimated marginal means with Bonferroni adjustment.

Table values represent observed descriptive data, whereas p values and pairwise comparisons were derived from mixed-effects models. A two-sided p value <0.05 was considered statistically significant.

2.6. Research ethics

The study was approved by the Biomedical Research Ethics Committee of Military Hospital 175 under Decision No. 4548/GCN-HĐĐĐ dated September 19, 2025. All participants were informed about the study objectives and procedures and provided written voluntary consent. Personal information was kept confidential and used solely for scientific research purposes.

III. RESULTS

Table 1. *General characteristics of the study population*

Characteristics		Number	Percentage
Age, years			
	≤60 years	24	38.7
	>60 years	38	61.3
Sex			
	Male	57	91.9
	Female	5	8.1
Cancer type			
	Esophageal cancer	32	51.6
	Gastric cancer	30	48.4
Disease stage			
Stage I–II		9	14.5
Stage III–IV		53	85.5
Treatment modality			
	Chemotherapy + radiotherapy	24	38.7
	Surgery + chemotherapy	21	33.9
	Other treatment modalities	17	27.4

The mean age of the study population was 62.7 ± 8.5 years, and patients aged >60 years accounted for 61.3%. Males predominated, accounting for 91.9%. Esophageal cancer and gastric cancer accounted for 51.6% and 48.4%, respectively. Patients with stage III–IV disease accounted for 85.5%. The most common treatment modality was chemotherapy combined with radiotherapy (38.7%), followed by surgery combined with chemotherapy (33.9%) (Table 1).

Table 2. *Changes in 24-hour dietary intake over time*

Parameter	T0, Baseline (n=62)	T1, 2 weeks (n=51)	T2, 1 month (n=61)	T3, 3 months (n=54)	p for time†
Energy, kcal/day	1414.7 ± 246.0	1340.4 ± 222.7	1354.3 ± 183.4	1391.0 ± 183.6	0.011
Energy/kg, kcal/kg/day	25.8 ± 3.3^{a}	25.2 ± 2.8^{a}	26.1 ± 2.5^{a}	27.2 ± 2.1^{b}	<0.001
Protein, g/day	69.8 ± 13.8^{a}	65.1 ± 12.4^{b}	66.1 ± 10.3^{ab}	67.3 ± 9.9^{ab}	0.003

Parameter	T0, Baseline (n=62)	T1, 2 weeks (n=51)	T2, 1 month (n=61)	T3, 3 months (n=54)	p for time†
Protein, g/kg/day	1.30 ± 0.20[a]	1.20 ± 0.10[b]	1.30 ± 0.10[ab]	1.30 ± 0.10[a]	0.001
Lipid, g/day	40.3 ± 7.6	39.3 ± 7.2	40.0 ± 7.1	39.9 ± 7.0	0.896
Lipid/kg, g/kg/day	0.70 ± 0.10	0.70 ± 0.10	0.80 ± 0.10	0.80 ± 0.10	0.091
Carbohydrate, g/day	181.5 ± 42.3[a]	162.7 ± 39.9[b]	165.2 ± 33.7[ab]	177.1 ± 34.4[ab]	0.001
Carbohydrate/kg, g/kg/day	3.30 ± 0.60[a]	3.00 ± 0.60[b]	3.20 ± 0.60[ab]	3.50 ± 0.60[a]	0.001

Values are presented as observed mean ± standard deviation (SD). Longitudinal changes were analyzed using linear mixed-effects models with time as a fixed effect and participant as a random effect. Pairwise comparisons were performed using estimated marginal means with Bonferroni adjustment. Different superscript letters indicate statistically significant differences between time points, whereas values sharing at least one letter are not significantly different. †p values represent the overall effect of time from the mixed-effects models.

Table 2 shows that the dietary intake changed significantly over time for energy, protein, and carbohydrate intake, particularly when expressed per kilogram of body weight. These parameters decreased at 2 weeks after treatment initiation and subsequently increased, reaching their highest or near-baseline levels at 3 months. In contrast, lipid intake, both in absolute terms and per kilogram of body weight, remained relatively stable throughout the follow-up period without significant changes.

As shown in Table 3, body weight and BMI decreased significantly over time, with significantly lower values at 3 months compared with baseline. Total PG-SGA score increased at 2 weeks, then decreased markedly by 3 months, reaching the lowest value at the final follow-up.

Table 3. *Changes in body weight, BMI, and total PG-SGA score during treatment*

Indicator	T0, Baseline (n=62)	T1, 2 weeks (n=51)	T2, 1 month (n=61)	T3, 3 months (n=54)	p for time†
Body weight, kg	55.45±10.3[a]	53.80±10.43[ab]	52.56±9.56[ab]	51.43±8.19[b]	0.001
BMI, kg/m²	21.94±4.07[a]	21.28±4.12[ab]	20.79±3.78[ab]	20.34±3.24[b]	0.001
Total PG-SGA score	8.66±3.35[a]	9.69±2.85[b]	9.18 ± 2.85[ab]	6.43 ± 3.03[c]	<0.001

Values are presented as observed mean ± standard deviation (SD). T0: before multimodal treatment; T1: after 2 weeks; T2: after 1 month; T3: after 3 months. Longitudinal changes were analyzed using linear mixed-effects models with time as a fixed effect and participant as a random effect. Pairwise comparisons were performed using estimated marginal means with Bonferroni adjustment. Different superscript letters indicate statistically significant differences between time points; values sharing at least one letter are not significantly different. †p values represent the overall effect of time from the mixed-effects models.

IV. DISCUSSION

4.1. General characteristics of the study population

In our study, patients with upper gastrointestinal cancer were predominantly male, and most were over 60 years of age. This finding is consistent with the epidemiological characteristics of gastric and esophageal cancers, which are more common in men and increase with age. Most patients had stage III–IV disease, reflecting the common clinical pattern in which upper gastrointestinal cancers are often detected at an advanced stage. The most common multimodal treatment strategies were chemotherapy combined with radiotherapy and surgery combined with chemotherapy. This patient group is at high risk of malnutrition due to the combined effects of cancer, inflammatory response, gastrointestinal symptoms, and treatment-related adverse effects [10].

4.2. Changes in dietary intake during treatment

In this longitudinal study, dietary intake changed significantly during the first three months of multimodal treatment. Total energy intake decreased from 1414.7 ± 246.0 kcal/day at baseline to 1340.4 ± 222.7 kcal/day at 2 weeks, then partially recovered to 1391.0 ± 183.6 kcal/day at 3 months. Similar early declines followed by gradual recovery were observed for protein and carbohydrate intake, whereas lipid intake remained relatively stable. This pattern identifies the first two weeks after treatment initiation as a particularly vulnerable period for nutritional deterioration in patients with upper gastrointestinal cancer.

This finding is clinically plausible because patients with esophageal and gastric cancer are simultaneously affected by tumor-related obstruction, anorexia, systemic inflammation, surgery, chemotherapy, radiotherapy, and nutrition-impact symptoms such as dysphagia, nausea, vomiting, mucositis, pain, fatigue, and early satiety. ESPEN guidelines recommend that nutritional care in cancer patients should include repeated assessment of nutritional status, dietary intake, and symptoms affecting food intake, with early intervention before severe malnutrition develops [2]. Previous studies in esophageal and upper gastrointestinal cancer have also reported high rates of malnutrition, insufficient dietary intake, and weight loss during treatment [11, 12].

A notable finding of the present study is the divergence between absolute intake and body weight–adjusted intake. Energy intake per kilogram increased significantly over time, reaching 27.2 ± 2.1 kcal/kg/day at 3 months, and protein intake per kilogram recovered to approximately 1.3 ± 0.1 g/kg/day. These values are close to ESPEN-recommended targets of approximately 25–30 kcal/kg/day and more than 1.0 g protein/kg/day, preferably up to 1.5 g/kg/day [2]. However, this improvement should be interpreted cautiously because body weight decreased progressively during follow-up. Thus, higher kcal/kg or g/kg values may partly reflect a lower body-weight denominator rather than a substantial increase in absolute intake.

This point represents an important contribution of the present study. In patients with upper gastrointestinal cancer, interpretation of dietary intake based only on kcal/kg or g/kg may overestimate nutritional recovery when body weight is simultaneously declining. This is particularly relevant because cancer cachexia is driven not only by reduced food intake but also by abnormal metabolism, systemic inflammation, and ongoing skeletal muscle loss that cannot be fully reversed by conventional nutritional support alone [13]. Therefore, nutritional response should be evaluated using a multidimensional approach, integrating absolute energy and protein intake, weight-adjusted intake, body weight, BMI, PG-SGA score, and nutrition-impact symptoms [3, 14].

Overall, the present findings suggest that multimodal treatment is associated with an early decline in dietary intake, followed by partial recovery over time. The persistence of weight loss despite improved weight-adjusted intake underscores the need for early, repeated, and comprehensive nutritional assessment throughout the treatment [2].

4.3. Changes in nutritional status during treatment

The present study demonstrated significant longitudinal changes in nutritional status during the first three months of multimodal treatment. Body weight decreased from 55.45 ± 10.30 kg at baseline to 51.43 ± 8.19 kg at 3 months, corresponding to an overall reduction of approximately 7.2%, while BMI declined from 21.94 ± 4.07 kg/m² to 20.34 ± 3.24 kg/m². These findings indicate a sustained deterioration in anthropometric status despite partial recovery of dietary intake during follow-up.

Progressive weight loss is a well-recognized feature of upper gastrointestinal malignancies and is driven by multiple mechanisms, including reduced oral intake, dysphagia, treatment-related toxicities, systemic inflammation, and cancer-associated metabolic alterations. According to the international consensus on cancer cachexia, weight loss in cancer patients reflects not only inadequate energy intake but also persistent catabolic processes that promote skeletal muscle wasting and negative protein balance, even when nutritional support is provided [13]. This mechanism may explain why body weight continued to decline in our cohort despite improvements in energy and protein intake observed at later follow-up visits.

In contrast to body weight and BMI, the PG-SGA score increased during the early treatment period and subsequently decreased substantially by month 3. Mean PG-SGA rose from 8.66 at baseline to 9.69 at 2 weeks, then declined to 6.43 at 3 months. This pattern suggests that nutritional risk initially worsened after treatment initiation, likely owing to acute nutrition-impact symptoms and treatment-related adverse effects, before improving as patients adapted to treatment and received ongoing nutritional care. Importantly, PG-SGA scores at 2 weeks and 1 month were within the range requiring urgent symptom management and nutritional intervention according to PG-SGA triage recommendations [3].

A notable finding of this study is the discordance between anthropometric indicators and PG-SGA trajectories. Although body weight and BMI declined continuously, PG-SGA improved significantly by the end of follow-up. This observation highlights the multidimensional nature of nutritional status in cancer patients. Unlike BMI, which reflects body size alone, PG-SGA incorporates recent weight change, dietary intake, nutrition-impact symptoms, functional capacity, and physical examination findings. Consequently, improvements in symptom burden and dietary intake may result in lower PG-SGA scores despite ongoing weight loss. Similar observations have been reported in studies evaluating nutritional status during cancer treatment, supporting the use of PG-SGA as a more comprehensive tool for monitoring nutritional risk [3].

The present findings have important clinical implications. The period between 2 weeks and 1 month after treatment initiation appears to represent a critical window for nutritional reassessment, as this was when PG-SGA scores peaked and weight loss became evident. Our results therefore support current ESPEN recommendations advocating repeated nutritional screening throughout cancer treatment rather than relying solely on baseline assessment [2]. Furthermore, the divergent trajectories of BMI and PG-SGA suggest that nutritional monitoring should integrate anthropometric measurements, dietary assessment, and validated screening tools to avoid underestimating nutritional risk in patients with upper gastrointestinal cancer. Our findings are consistent with a previous longitudinal study by Hill et al., which reported that poor nutritional status and weight loss were associated with radiotherapy-related toxicity and treatment outcomes in patients with gastrointestinal cancer. This supports the clinical relevance of repeated nutritional monitoring during multimodal treatment, particularly in the early treatment phase when dietary intake declines and weight loss becomes evident [15].

This study has several strengths. Its longitudinal design with four predefined assessment points allowed early nutritional changes during multimodal treatment to be captured. The combined use of PG-SGA, anthropometric indicators, and repeated 24-hour dietary recalls provided a multidimensional assessment, while mixed-effects models strengthened the analysis of repeated measures. These findings add clinically relevant longitudinal evidence from Vietnam, where data on nutritional trajectories in upper gastrointestinal cancer remain limited.

Several limitations should also be acknowledged. The small sample size and convenience sampling may limit generalizability. Dietary recall may be affected by recall bias and portion-size estimation errors. Subgroup analyses by treatment modality, disease stage, and nutritional intervention intensity were not performed, and body composition was not directly assessed by CT or BIA. Future studies with larger samples and body composition measurements are needed to further clarify nutritional changes during treatment.

V. CONCLUSION

In patients with upper gastrointestinal cancer receiving multimodal treatment at Military Hospital 175, nutritional status and dietary intake changed significantly during the first three months of follow-up. Body weight and BMI declined progressively, whereas the total PG-SGA score increased in the early treatment phase, peaked at 2 weeks, and then improved markedly by 3 months. Energy, protein, and carbohydrate intake decreased shortly after treatment initiation and subsequently showed partial recovery, while lipid intake remained relatively stable.

These findings indicate that the first weeks after treatment initiation represent a critical period for nutritional deterioration. Regular nutritional monitoring using PG-SGA, anthropometric indicators, and dietary intake assessment should be integrated into multimodal cancer care to enable timely, individualized nutritional intervention.

References

1. Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, et al. Global Cancer Statistics 2022: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA: A Cancer Journal for Clinicians. 2024 Apr 4;74(3):229–63. doi: 10.3322/caac.21834.
2. Muscaritoli M, Arends J, Bachmann P, Baracos V, Barthelemy N, Bertz H, et al. ESPEN practical guideline: Clinical Nutrition in cancer. Clinical Nutrition. 2021 Mar;40(5): 2898-2913. doi: 10.1016/j.clnu.2021.02.005.
3. Bauer J, Capra S, Ferguson M. Use of the scored Patient-Generated Subjective Global Assessment (PG-SGA) as a nutrition assessment tool in patients with cancer. Eur J Clin Nutr, 2002. 56(8): 779-85. doi: 10.1038/sj.ejcn.1601412.
4. Shah MA, Kennedy EB, Catenacci DV, Deighton DC, Goodman KA, Malhotra NK, et al. Treatment of Locally Advanced Esophageal Carcinoma: ASCO Guideline. J Clin Oncol. 2020 Aug 10;38(23):2677–94. doi: 10.1200/JCO.20.00866.
5. Lordick F, Carneiro F, Cascinu S, Fleitas T, Haustermans K, Piessen G, et al. Gastric cancer: ESMO Clinical Practice Guideline for diagnosis, treatment and follow-up. Ann Oncol, 2022 Jul 29. 33(10): 1005-1020. doi: 10.1016/j.annonc.2022.07.004.
6. Obermannová R, Alsina M, Cervantes A, Leong T, Lordick F, Nilsson M, et al. Oesophageal cancer: ESMO Clinical Practice Guideline for diagnosis, treatment and follow-up. Ann Oncol, 2022 Oct. 33(10): 992-1004. doi: 10.1016/j.annonc.2022.07.003.
7. Dinh Ngoc Diep, Phan Tran Thien Nhan, Nguyen Le Quynh Nhu. status of gastric cancer patients before surgery at Binh Dan Hospital, 2022. Vn J Nutr Food, 2024 Oct 28, 20(5):79-84. doi: 10.56283/1859-0381/729.
8. Pham Duc Minh, Nguyen Thi Diu. Nutritional status, dietary intake and nutrition impact symptoms of cirrhotic patients. Vn J Nutri Food. 2023 Jun 28;19(3E):23-32. doi:10.56283/1859-0381/396.
9. Detry MA, Ma Y. Analyzing Repeated Measurements Using Mixed Models. JAMA. 2016 Jan 26;315(4):407-8. doi: 10.1001/jama.2015.19394.
10. Hebuterne, X., E. Lemarie, M. Michallet, et al., Prevalence of malnutrition and current use of nutrition support in patients with cancer. JPEN J Parenter Enteral Nutr, 2014. 38(2): 196-204. doi: 10.1177/0148607113502674.
11. Movahed S, Norouzy A, Ghanbari-Motlagh A, Eslami S, Khadem-Rezaiyan M, Emadzadeh M, et al. Nutritional Status in Patients with Esophageal Cancer Receiving Chemoradiation and Assessing the Efficacy of Usual Care for Nutritional Managements. Asian Pac J Cancer Prev, 2020 Aug 1. 21(8): 2315-2323. doi: 10.31557/APJCP.2020.21.8.2315.
12. Pham Van B, Nguyen Thi Thanh H, Le Thi H, Nguyen Le Tuan A, Dang Thi Thu H, Dang Viet D. Nutritional Status and Feeding Regimen of Patients with Esophagus Cancer-A Study from Vietnam. Healthcare (Basel), 2021 Mar 6. 9(3): 289. doi: 10.3390/healthcare9030289.
13. Fearon K, Strasser F, Anker SD, Bosaeus I, Bruera E, Fainsinger RL, et al. Definition and classification of cancer cachexia: an international consensus. Lancet Oncol, 2011. 12(5): 489-95. doi: 10.1016/S1470-2045(10)70218-7.
14. Zhang L, Lu Y, and Fang Y. Nutritional status and related factors of patients with advanced gastrointestinal cancer. Br J Nutr, 2014 Jan 8. 111(7): 1239-44. doi: 10.1017/S000711451300367X.
15. Hill A, Kiss N, Hodgson B, Crowe TC, Walsh AD. Associations between nutritional status, weight loss, radiotherapy treatment toxicity and treatment outcomes in gastrointestinal cancer patients. Clin Nutr, 2011 Feb. 30(1): 92-8. doi: 10.1016/j.clnu.2010.07.015.